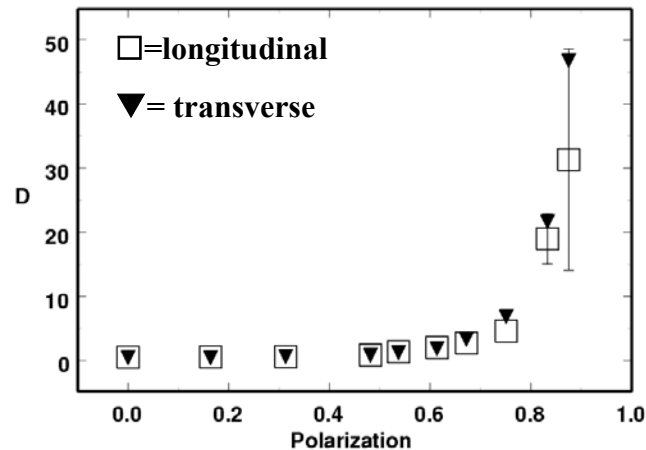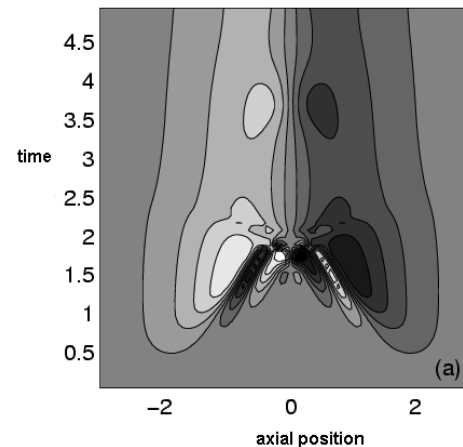# RUI:Computational Studies of Spin Transport in Quantum Fluids and Solids

Robert Ragan, Univ. Wisconsin - La Crosse, DMR-0071706

At temperatures near absolute zero, the quantum mechanics of collections of identical particles holds many surprises. Spin transport is an important probe into the dynamics of these systems. Our recent research involves analyzing the effects of spin-wave instabilities in liquid He-3. We have also performed simulations of spin diffusion in paramagnetic crystals, where the indistinguishishability of the particles is the sole mechanism of spin transport. Currently we are studying exchange effects in the pseudo-spin dynamics of hyperfine levels of trapped alkali gases.

Monte Carlo calculation of spin diffusion coefficients in a 2-d Heisenberg paramagnet as a function of the polarization. *JLTP* **126, 45** *(2002)*

Simulation of the spatial segregation of hyperfine states (light and dark areas) in a trapped [87]Rb gas. *J. Low Temp. Phys.* (in press).

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Education:

Four undergraduates (Mani Bidar, Chris Glenz, Kurt Grunwald, Brian Batell, and Dan Tesar) contributed to this work. Mani Bidar graduated in 2003 with B.S. degrees in Physics and Electrical Engineering. Chris Glenz graduated in 2002 with a B.S. in Physics and is now traveling in Asia. Brian Batell is pursuing a Ph.D. in theoretical physics at the University of Minnesota. Dan Tesar received a B.S. in Physics in 2003 with Computational Physics Emphasis, and is currently employed at Dairyland Power. Kurt Grunwald is pursuing a BS in Physics with an Astronomy Emphasis.

Outreach:

With undergraduate student Michael Graybar, the PI conducted a "Girls in Science" workshop in which

participants, aged 12-15, investigated self-similarity and fractal dimension with paper cuttings and computer graphics.

The PI discussing fractal computer images with "Girls in Science" participants.